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LCS Anti-Submarine Warfare Mission Package Rolls Out

The Navy rolled out its new Anti-Submarine Warfare (ASW) Mission Package (MP) for the Littoral Combat Ship (LCS) in a ceremony held on Sept. 19 at the Naval Mine and ASW Command Complex, San Diego. Speakers at the event included the Principal Civilian Deputy to the Assistant Secretary of the Navy for Research and Development, Jim Thomsen; Program Executive Officer for Littoral and Mine Warfare, E. Anne Sandel; and SPAWAR Commander Rear Adm. Michael Bachmann.

LCS is the first Navy shipbuilding program to develop and utilize the combined Sea Frame and MP concept. While Sea Frame will provide permanent self-defense capabilities, other major elements of the ship's combat system will be embedded in modular mission packages. These modules are designed for rapid shipment, installation, removal, and reconfiguration, and are optimized for flexibility in the littorals to detect, identify, target, and destroy enemy threats.

The Unmanned Systems Branch at SSC Pacific developed the command and control software used to guide the LCS unmanned surface vehicles (USVs) in their search for quiet submarines operating in the littoral environment. The Multi-Robot Operator Control Unit (MOCU) architecture was designed to dynamically load mission-specific modules at run-time, providing an extremely modular and flexible user interface. This approach allows application-specific needs such as input devices, output displays, and communication protocols to be easily replaced or altered via XML configuration files that can be modified with a standard text editor. As a result, there is no need to recompile the core software to implement major changes, which accommodates user preferences, facilitates interoperability, and encourages third-party development.

RADM Mahon addresses ASW community at MP rollout.

Two key MOCU elements for the LCS USVs are the *C2 Link* and *Digital Nautical Chart*

Continued page 2

Autonomous UAV Mission System Achieves Key Milestone

AUMS with the iStar UAV mounted on an MDARS UGV in 2004.

The Autonomous UAV Mission System (AUMS) is designed to forward deploy and autonomously refuel small vertical-takeoff-and-landing (VTOL) unmanned air vehicles (UAVs). Small VTOL UAVs offer unique capabilities in reconnaissance, surveillance, targeting, and assessment missions, but suffer from short range and low flight endurance. AUMS addresses these shortcomings by providing a modular launch/recovery and refueling station for the UAV.

The system can be used stand-alone or mounted to a ground or surface vehicle, either manned or unmanned. When installed on an unmanned vehicle, AUMS provides a means to carry the UAV into the battlespace without exposing operators to unnecessary risk. Once on station, AUMS can repeatedly launch, recover, refuel, and relaunch the UAV for as long as necessary to accomplish its mission.

SSC Pacific engineers recently achieved a significant milestone in demonstrating a complete AUMS cycle. A small helicopter was used to perform a launch, execution of a predefined waypoint course, landing on the platform, refueling of the helicopter, a second launch, waypoint navigation, and a second landing. This cycle was performed autonomously with the only operator intervention being simple keyboard inputs to initiate the launch, landing, navigation, and refueling stages of the mission.

The UAV used in development is a 15-pound gasoline-powered helicopter modified by SSC Pacific engineers for the AUMS application. The helicopter is equipped with an autopilot manufactured by Cloud Cap Technologies and utilizes a Novatel differential GPS to provide sufficient navigation precision for the autonomous landing on the platform. This helicopter was employed as a low-cost expendable surrogate for development purposes, but system hardware and software are applicable to other small VTOL vehicles, such as the Honeywell MAV.

The AUMS team recently

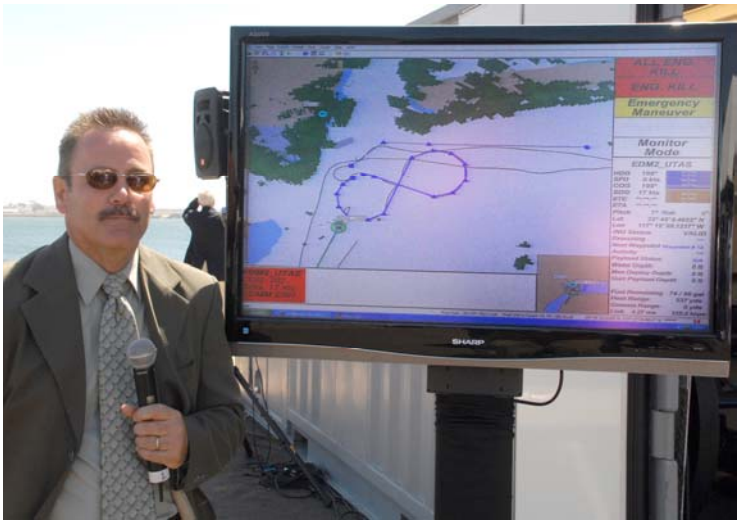
Continued page 2

LCS Anti-Submarine Warfare Mission Package Rolls Out (*continued*)

UTAS USV demonstration on the San Diego Bay.

(DNC) modules. During a demo of the USV Towed Array System (UTAS), the USV operators plotted two courses via MOCU: a high-speed (30-knot) run from the center of San Diego harbor to a position between Harbor Island and Point Loma, where the USV then transitioned to a low-speed (10-knot) figure-8 pattern simulating a sonar sweep. The C2 Link allows MOCU to integrate with a variety of command and control packages used throughout the fleet to relay instructions to the USV. The DNC module provides full up-to-date information on nautical obstacles and allows MOCU to provide feedback to the operators if the requested course violates safe navigation practice.

In June of 2008, a Technology Transition Agreement (TTA) was signed by the Program Manager for LCS Mission Modules (PMS 420) to continue the maturation of MOCU. A key to the transition process is the incorporation of human factors elements via a program with the Office of Naval Research (ONR) to optimize the interface for reduced operator workload.♦



Rollout Master of Ceremonies Robert Kosman explains the USV demo routes displayed on MOCU to the audience.

Autonomous UAV Mission System Achieves Key Milestone (*continued*)

AUMS mounted on a unmanned HMMWV at AFB Eglin during

participated in a successful demonstration as part of the Joint Collaborative Technologies Experiment (JCTE). The JCTE is a 2-year Joint Ground Robotics Enterprise (JGRE) effort to demonstrate value added to the warfighter in utilizing multiple unmanned systems collaborating towards a common goal. The demonstration conducted at Tyndall AFB featured three unmanned ground vehicles, AUMS, and two other UAVs in a site-security application. All unmanned systems used the Joint Architecture for Unmanned Systems (JAUS) messaging protocol and were controlled using SSC Pacific's Multi-robot Operator Control Unit (MOCU). AUMS was mounted on an unmanned HMMWV and the helicopter provided aerial ISR support to operators directing armed UGVs to intercept an intruder.

Ongoing efforts to improve system performance will include refinements to the flight control laws to improve landing precision, addition of autonomous abort logic to wave off a landing if the UAV detects an out-of-limits condition during approach, and increased levels of autonomy for both AUMS and the UAV to further reduce operator workload. We are also actively pursuing a vision-based scheme for guiding the precision landing phase in GPS-denied areas. The AUMS team is currently pursuing a specialized high-frame-rate-based video processing scheme for augmenting the precision landing phase in GPS-denied areas, which is funded by ONR-Global.♦

AUMS PM Mike Wills discusses applications for vision technology with Dr. Clay Stewart, Technical Director, ONR-Global.

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